
Cube Detector



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Overview

Stages of Project:

Neural Network Parameter Tuning

Data Collecting

Data Tuning

Testing on Cozmo

Refinement

Neural Network Parameter Tuning

Changes That Worked

- Large Kernel Size (11x11)
- Increased Kernels in Second Level
- Large Number of Kernels in First Level

Changes That Didn't

- More Hidden Layers
- Larger Pool Size
- Small Kernel Size

Neural Network Architecture

Two layer CNN:

First level has 32 Kernels with size 11, a stride of 1, padding of size 2, and pooling of size 4

Second level has 12 Kernels with size 11, a stride of 1, padding of size 2, and pooling of size 4.

Data Collecting

Cube Data

- Tried to vary data where the cube was on the right half and Cozmo did not recognize the cube
- Varied background, light exposure, surface

No Cube Data

- Tried to have the no cube pics resemble the cube pics exactly with the cubes missing

Data Tuning

Features

- Random cropping to make the dataset larger
- Shuffle
- Increase in batch size and epoch

Correct Rate

- The correct rate is about around 95-97% in the sample data

Testing On Cozmo

Positives

- Able to detect cubes on the left and right edge
- Can distinguish objects that are not cubes that are in the dataset

Negatives

- Issues depending on lighting
- Background

Refinement

Changes

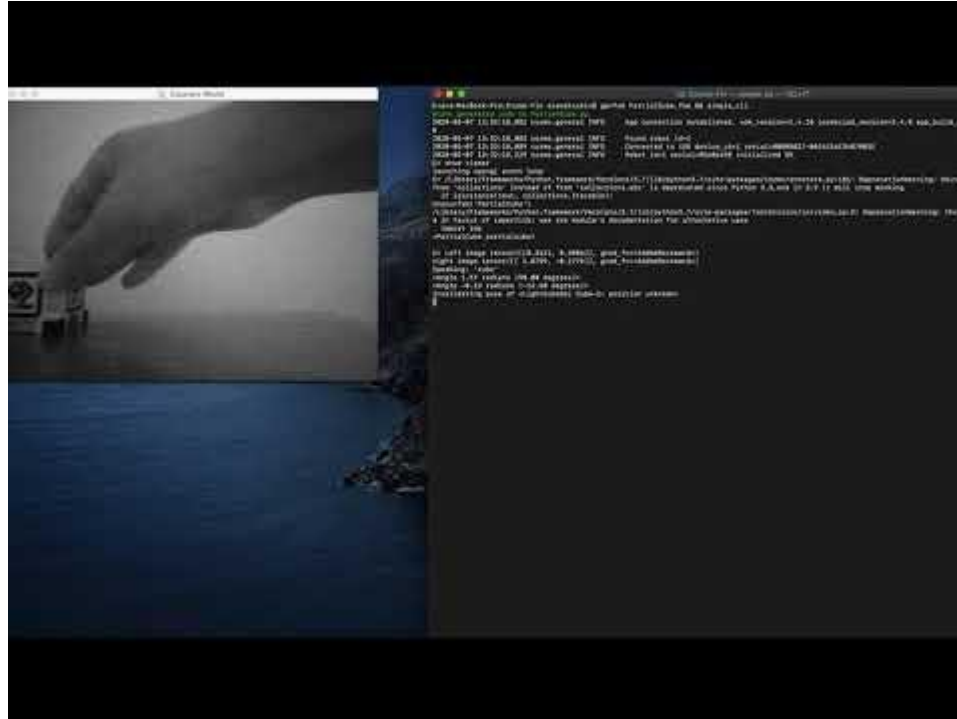
- Increased Batch Size
- Realized there was mislabeled data in the data set
- Learning rate and momentum change

Improvements

- Now Correctly labels the data
- Added more data with more background noise

Results

Turn Towards Cube Demo



Discussion of Results

Object Detect

- Cozmo can differentiate random objects from cubes
- Can detect both on the left half of the screen and the right
- Correctly realizes when there is not a cube

Turn

- Correctly turns to the left when the cube is on the left half
- Correctly turns to the right when the cube is on the right half
- Does nothing when no cube

Major Issues

Issues

- Incorrect behavior based on lighting conditions
- Other objects not being recognized as not a cube
- Normalization

Solutions

- Normalize the images
- Include more non cube objects in the data set
- Normalization parameters change depending on batch size need a concrete way to fix this